DOCUMENT RESUME

ED 234 908 PS 013 848

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TITLE Accessing Cognitive Skills in Preschool Children of Middle and Low Income Families.
PUB DATE Jun 82
NOTE 13p.; Paper presented at the Annual Symposium of the Jean Piaget Society (12th, Philadelphia, PA, June 3-5, 1982).
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Child Development; *Cognitive Ability; *Learning Theories; Low Income Groups; Middle Class Students; Preschool Education; *Preschool Tests; Socioeconomic Influences
IDENTIFIERS *Cognitive Research; Piagetian Theory

ABSTRACT

The present study (1) explores the extent to which the standard format of the conservation assessment task may mask conserving abilities of preschoolers and (2) investigates how the wording of a typical conservation task may affect the type of justifications offered by children of two different socioeconomic backgrounds. Subjects included 48 4- to 6-year-old preschool and kindergarten children (25 girls and 23 boys). Half were from middle-class families, and the other half were from low-income families. The experimental design included three phases: a pretest to establish the nonconserving status of all participants, a limited conservation training intervention, and conservation posttests. Subjects were grouped by socioeconomic status and assigned to either the training condition or to one of the two control conditions. Results indicated that logical problem-solving strategies considered typical of the concrete operational period can be tapped at an earlier age, provided the task is structured in a manner that diminishes the role of irrelevant cues and facilitates the emergence of logical reasoning skills. It is concluded that findings supported Piaget's conception that reversible thought processes form the core of the solution to the conservation problem and that justifications emanate from a coordinated and reversible structure. Overall, low-income children performed as well as middle-class children, a fact that confirms the generality of the cognitive strengths uncovered. (BJD)

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ED234908

Accessing Cognitive Skills in Preschool Children of Middle and Low Income Families

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PS 013848

Paper delivered at the Symposium "Moderators of Competence"

Twelfth Annual Symposium of the Jean Piaget Society

June 3-5, 1982, Philadelphia

Accessing Cognitive Skills in Preschool Children of Middle and Low Income Families

The problem of the order in which logical explanations of identity, inversion and compensation to the conservation problem are acquired by preoperational children has been a source of controversy between predominantly American and Genevan investigators. American investigators (Acredolo & Acredolo, 1979; Bruner, 1966; Elkind & Schoenfeld, 1972; Field, 1977, 1981; Hamel & Riksen, 1973) stress the predominance of identity responses on trained conservation, and contend that the preoperational qualitative notions of identity are the developmental precursors of the more quantitatively oriented justifications typical of the concrete operational period which, according to Piaget, is characterized by its reversibility. Piaget denies the claim that qualitative identity provides a link to the more advanced forms of conserving justifications. The latter are based on the understanding that certain transformations, for example, in shape, size or length, do not affect the quantity if nothing has been added or subtracted (identity), that this can be demonstrated by canceling the transformation (inversion), and that an explanation of the phenomenon requires reference to two dimensions, i.e., what is gained in one is lost in the other (compensation). To quote Piaget directly: "It is, then, the total system or grouping which is responsible for the formation of the conservations, and not identity. Identity is but one element which has been transformed by the system itself, rather than being the source of the system." (1968).

The prevalence of identity responses on conservation training studies has usually been interpreted as lending support to the qualitative status of identity explanations. However, Field's (1977) finding that the type of explanation is also a function of the particular quantity involved, suggests that the preponderance of identity responses may, in part, be situationally determined, by the particular task and the form in which the questions are stated. Indeed, in the usual conservation training task, the initial state of the quantity, i.e., the original identity prior to the transformation of the material is stressed and even demonstrated. Futhermore, in the conventional pre- and posttests the examiner, repeatedly refers to the identity concept when s/he uses such terms as "same" and "more." Thus the standard format of conservation training and testing appears to predispose the child toward an identity explanation. Support for such an interpretation also comes from the pretense play studies (Golomb & Cornelius, 1977; Golomb, Gowing & Friedman, 1982) which report that although previously nonconserving preschoolers who participated in pretense play sessions were able to offer, without further training all three types of explanation, the identity responses were the most prevalent ones. Finally, with the exception of Goodnow (1973), investigators haved failed to examine the potential effects of the wording of the questions on the type of explanation. When researchers have considered explanations in addition to judgments, they have usually phrased their questions in the manner of "How do you know?" or "how can you tell?" or a simple variant thereof, a format that may well have encouraged the production of identity responses.

The present study explores the extent to which the standard format

of the conservation assessment task may mask conserving abilities of preschoolers, and how the wording on a typical conservation task may affect the type of justifications offered by children of two different socioeconomic backgrounds.

In the conventional conservation task, the child is usually presented with two equal looking quantities. Next, the examiner transforms one of the quantities, for example, a ball of playdough into a long sausage, and asks the child whether both still have the same amount or one has more. The striking change in the appearance of the quantity and the format of the question may well encourage a nonconserving response and thus mask the availability of logical reasoning strategies. With these considerations in mind we modified the conservation posttest in two major ways: (a) Following the transformation of one of the two equal looking quantities, the child was provided with the correct conserving judgment and asked for his explanation; (b) The phrasing of the questions was intended to elicit the three different types of justifications. Thus following the judgment of equality, the examiner's question "Can you tell me <u>why</u> they both still have the same amount" refers to the child's knowledge that both quantities were the same to begin with and that they still ought to be the same. The question "<u>What</u> could you do to show me that they still have the same amount" asks for a demonstration or proof of the child's knowledge, and encourages an inversion response. Lastly, a question such as "<u>How</u> can the water in this one be so much taller and still have the same amount as this one (standard) ?" really asks for an explanation of the phenomenon itself, namely of the perceptual change in the appearance of the quantity, and encourages a compensation response. Since SES has

often been implicated in the poorer performance of children from low income families (Griffing, 1980; Gullo, 1981; Mumbauer & Miller, 1970; Smith & Dodsworth, 1978), potential social class effects need to be examined.

In summary, the present study was designed to explore the following questions: (a) Can nonconserving children be induced to offer conserving explanations when the format of the conservation posttest is changed? (b) Does the wording of the question on a typical conservation task affect the type of justifications offered by the child? (c) What are the effects of SES on a task that calls for the verbal articulation of the conservation rule?

Methods

Subjects

The participants were 48, 4 to 6 year old preschool and kindergarten children from the greater Boston area. Half of the children came from middle class families, the offspring of college educated parents, while the other half came from low income families whose education usually did not exceed beyond high school. Altogether 23 boys and 25 girls participated in this study.

Experimental Design

The design included three separate phases: a pretest to establish the nonconserving status of all the participants, a limited conservation training intervention, and conservation posttests. Following the pretests, subjects were grouped by SES and assigned either to the training condition or to one of the two control conditions: a standard conservation posttest or a modified conservation posttest. Subjects in the training group and in one of the control groups received the modified

conservation posttest; the second control group received the standard posttest version. The modified conservation posttest provided the child with the correct judgment and posed three sets of questions designed to elicit identity, inversion and compensation responses, respectively. The control group that received the conventional format was asked for its judgment of quantity, followed by the standard question: "Can you tell me why?"

Tasks and Procedures

Conservation pretests, Day 1. One solid and one liquid quantity task, each involving a single transformation was presented twice in succession: first the examiner performed the transformation and asked the child for a judgment and explanation, next the child performed the same transformation and the examiner, as on the previous trial, again asked for the child's judgment and explanation. The child's reasoning was probed in a series of questions: "Do both of these have the same amount of water (clay) or does one have more?" "How do you know?" "I can see that this water (clay) looks taller (longer) but does that mean that it has more water (clay)?" "How much was there to begin with?" "How much is there now?" "How did this happen?" "Now I am going to put this water (clay) back the way it was. Now do both have the same amount of water (clay)?"

Conservation training, Days 2, 3 and 4. Tasks included solid and liquid quantities. On Days 2 and 3 one of two identical balls of playdough was transformed into a snake and a doughnut, respectively, a single transformation per day. On Day 4 the transformation was performed on liquid quantity. Following the transformation the examiner offered a conserving judgment: "Even though these two look different, they still

have the same amount of clay. To insure that the child was paying attention to the information given by the examiner, she asked the child to repeat the correct judgment: "Can you tell me what I said? What do you think about what I just said? Do you think that's possible?" Each task was administered twice: on the first trial the examiner performed the transformation, on the second trial the child made the transformation.

Modified conservation posttest, Days 5 and 19. Tasks included three transformations on solid quantity and three transformations on liquid quantity. Following each transformation the examiner offered the child the correct judgment and presented the following series of questions: (1) "Can you tell me why they still have the same amount clay (water)?" (2) "How could you show me that they still have the same amount of clay (water)?" (3) "If you look at both of these (standard and transformed stimulus) how would you know that they still have the same amount? How can the water (clay) in this one be so much taller and still have the same amount as this one (standard)?"

Standard conservation posttest, Days 5 and 19. The tasks were identical with the ones described for the modified conservation posttest. Following each transformation, the examiner asked the child for his judgment and explanation, following the format described for the conservation pretests.

Scoring Criteria

A nonconserving judgment received a score of 0, a conserving judgment a score of 1 (applicable to the pretest and the standard control posttest).

A correct explanation of identity, inversion or compensation which showed understanding but lacked full verbal articulation received a score of 1; a correct and verbally well articulated formulation received a score of 2. Subjects who received the modified conservation posttest

did not receive credit for judgments although their credit for a correct explanation also required an explicitly affirmed conserving judgment (applicable to the modified conservation posttest groups).

Results

Data analyses (ANOVA) indicated that the overall differences between the groups were statistically significant ($p < .01$); the treatment effect (modified conservation posttest) was an effective variable but SES was not statistically significant. Between-group comparisons (combined for SES) indicated that the comparisons failed to yield significant differences. Apparently, the effects of the modified conservation posttest condition masked the potential effects of the treatment condition. (For a distribution of mean scores, see Table 1).

Insert Table 1 About Here

Regarding the distribution of identity, inversion and compensation explanations, the findings indicate that a significant relationship exists between the type of question and the type of explanation ($p < .001$). The highest frequencies were obtained for identity and inversion explanations, however 46% of the subjects receiving the modified conservation posttest gave all three types of explanation.

Discussion

The results of our study indicate the effective impact of the modified conservation posttest which elicited conserving explanations from previously nonconserving children. Since the explanations included identity, inversion and compensation statements, it appears that logical problem solving strategies considered typical of the concrete operational period can be tapped at an earlier age, provided the task is structured in a manner that diminishes the role of irrelevant cues and thus facilitates the emergence of logical reasoning skills. Our findings highlight the diverse problem solving strategies which children can apply to the conservation task. The reported prevalence of identity explanations seems to have been a function of the structure of

the task and the format of the question rather than an expression of a primitive qualitative mode of reasoning. These findings support Piaget's conception that reversible thought processes form the core of the solution to the conservation problem, and that all three types of justifications emanate from a coordinated and reversible structure.

The finding that, overall, low income children performed as well as middle class children confirms the generaltiy of the cognitive strategies which we have uncovered.

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Table 1

The Effect of Treatment and Social Class on Conservation Attainment

Group	SES	N	Conservers[1]	Total Score	Mean Score[2]
			Posttest 1		
Conservation Training	middle class	8	7	54	6.75
	low income	8	5	23	2.88
Modified Posttest-only	middle class	8	5	35	4.38
	low income	8	5	50	6.25
Standard Posttest-only	middle class	8	0	0	0
	low income	8	0	0	0
			Posttest 2		
Conservation Training	middle class	8	7	49	6.13
	low income	8	7	25	3.13
Modified Posttest-only	middle class	8	6	44	5.5
	low income	8	7	39	4.88
Standard Posttest-only	middle-class	8	1	4	0.50
	low income	8	0	0	0

Note 1: Subjects who gave a conserving response on at least one of the six tasks of the posttest were classified as "conservers".

Note 2: Possible range of scores per posttest from 0-12.